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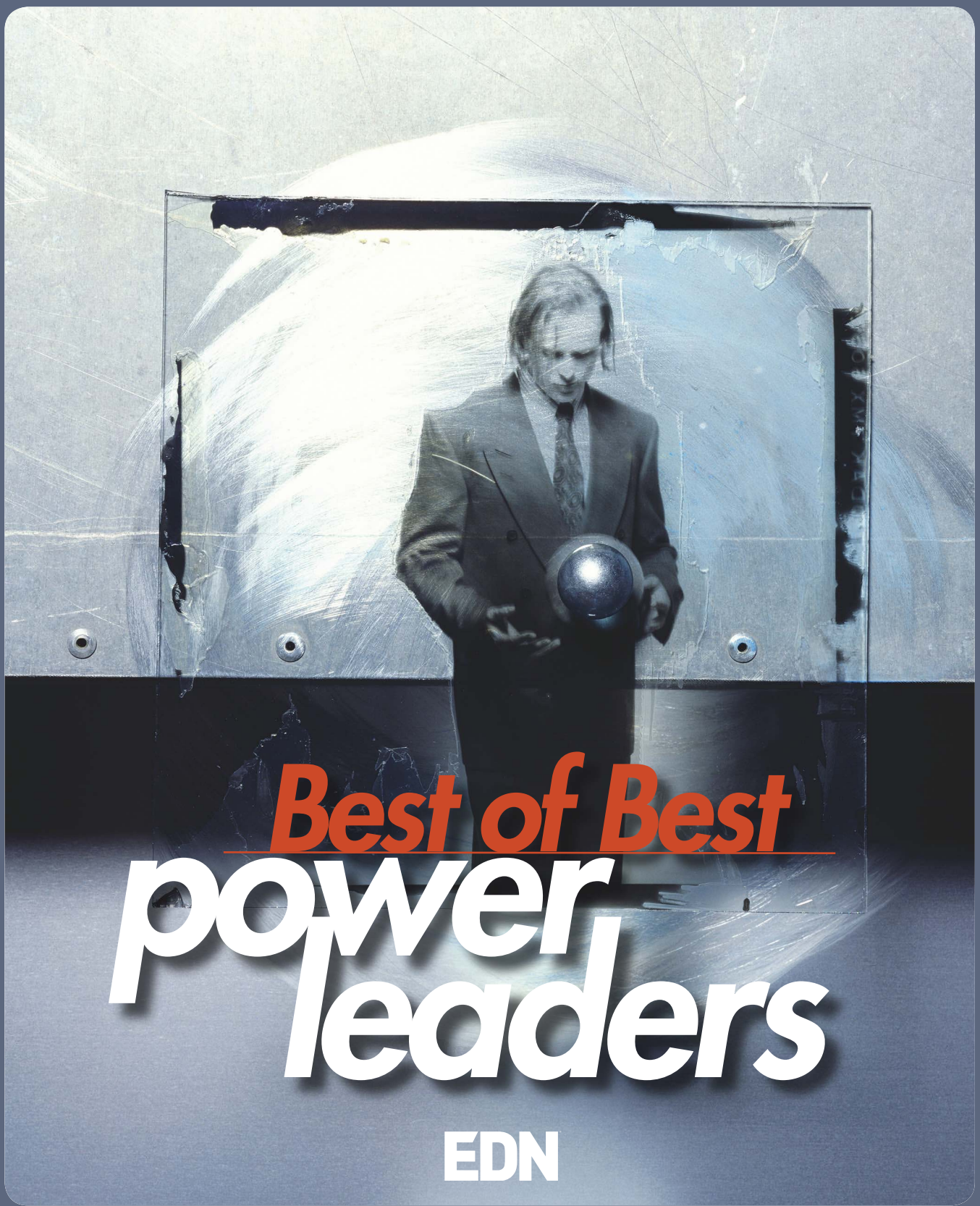
SEPTEMBER 2008

POWER TECHNOLOGY



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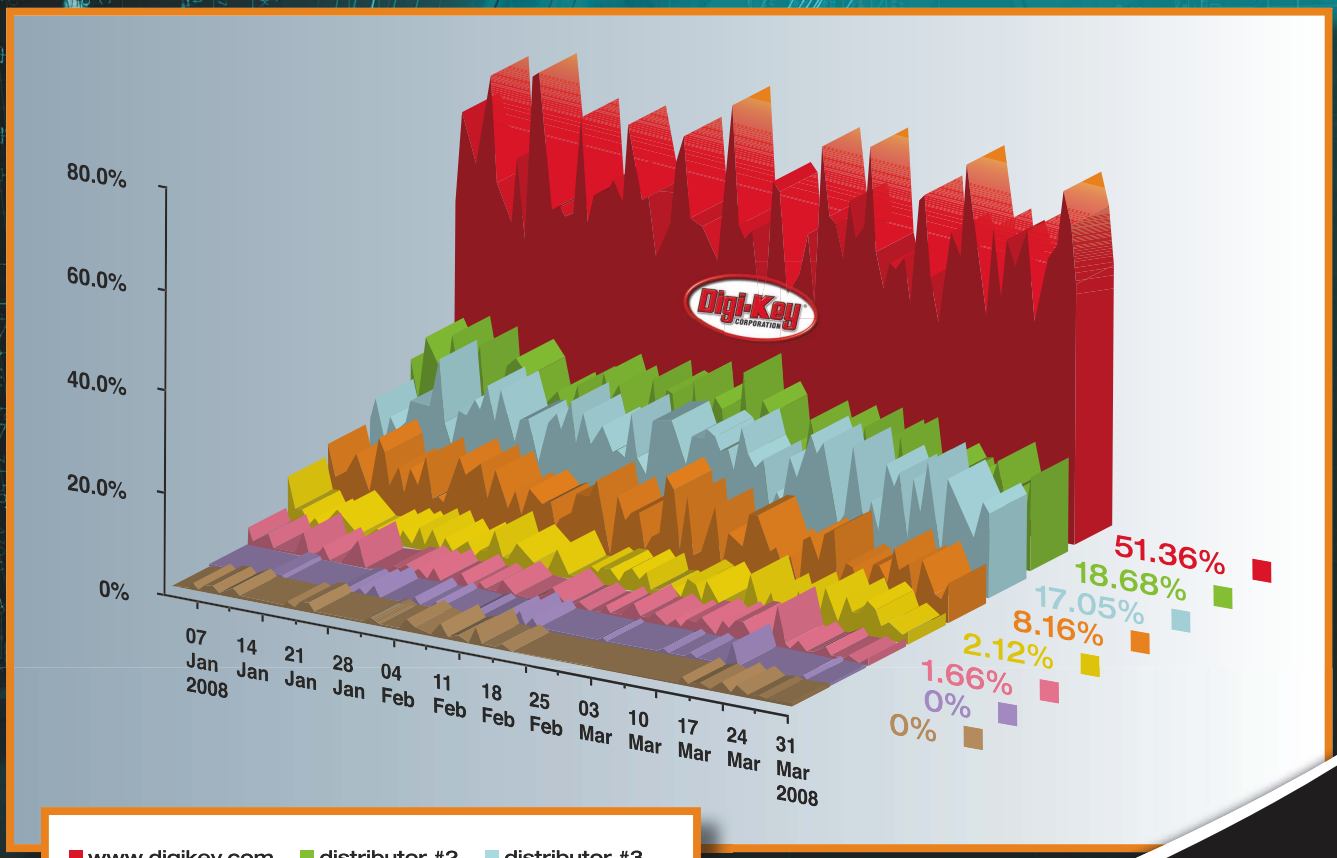

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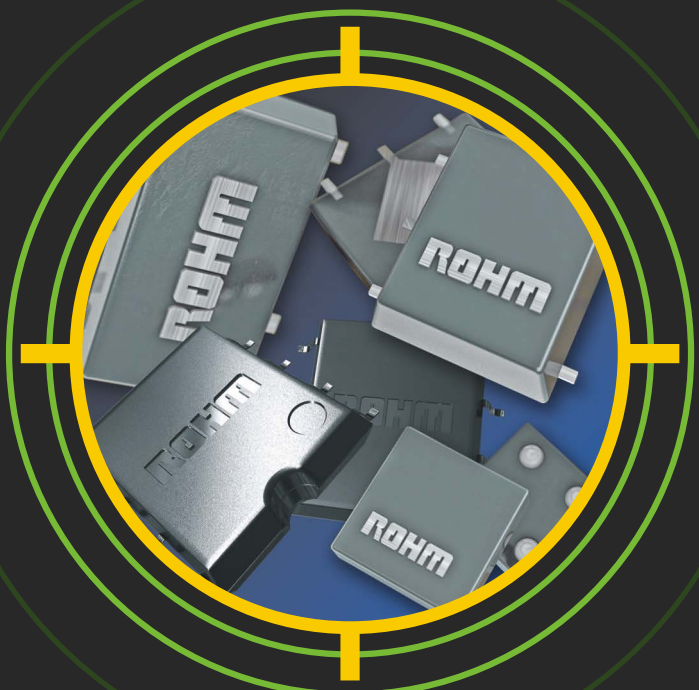

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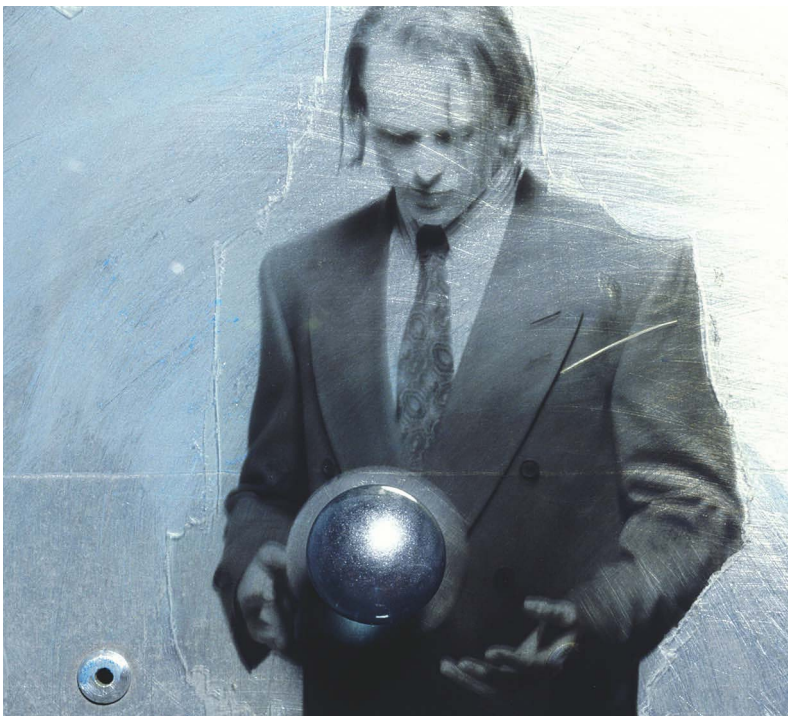

EDN's BEST OF BEST

MARGERY CONNER,
TECHNICAL EDITOR,
POWER SYSTEMS AND
COMPONENTS, EDN

Letter from the editor: Power Industry Overview

EDN's Power issue last May, "Best of Power," focused on *EDN*'s most popular power content for 2007 based on visits by EDN.com viewers. This issue, "Power Leaders," takes a look at the leading power semiconductor vendors for power transistors, power management ICs, photovoltaics, and digital power. And in a nod to a future market segment, we take a look at an emerging technology in the automotive world: The plug-in hybrid electric vehicle (PHEV), also called the extended-range EV. Where revenues are established and trackable, we list which companies are the top 10 or 20 for each segment based on revenues; in emerging markets, we list companies which are likely contenders.

Power electronics were strong in 2007 and will continue so for at least the near future because of the global need to increase energy efficiency in the face of rising energy costs. Power supplies for electronics used to be a necessary evil – now they can be a differentiating feature as vendors look for ways to squeeze more capabilities out of less power, and end-customers weigh paying a little more up-front to save more on their overall energy costs.

As an example of the relative strength of the power market, Gartner – Dataquest predicts that the voltage regulator segment of the semiconductor market will have a compound annual growth rate (CAGR) of 7.2% from 2006-2008, which is slightly faster than that of the overall analog IC segment, which Gartner forecasts will grow at a CAGR of 6.4%, and much faster than that of the total semiconductor segment, which it expects will grow at a CAGR of 4.8% over the same period.

Read Margery Conner's PowerSource blog at www.edn.com/powersource.

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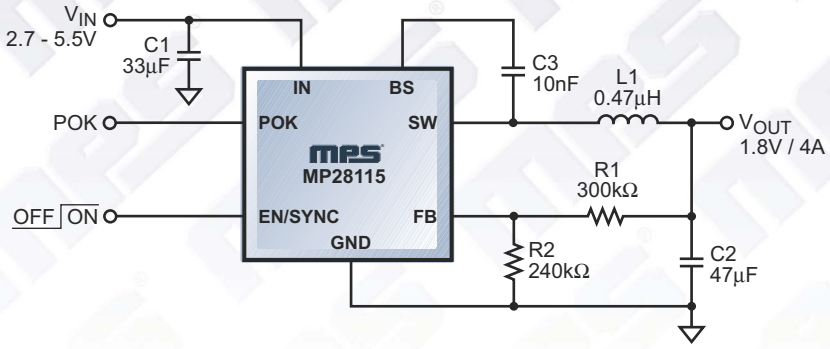
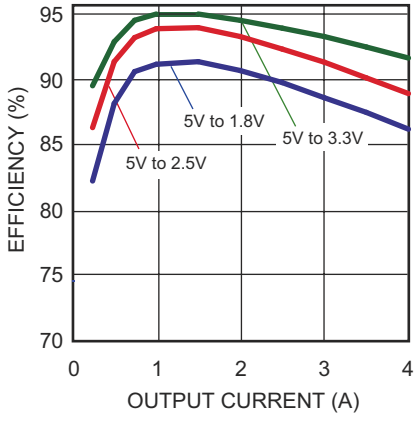


Efficiency vs Output Current



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- *93% Efficient @ 3A*
- *All Ceramic Capacitor Design*
- *Internal Soft-Start and Compensation*

Power Your Designs with Greater Efficiency!

Part	Switch Frequency	Efficiency	$R_{DS(ON)}$	V_{IN} (V)	V_{OUT} (V)	I_{OUT} (A)	Package Footprint
MP28115	1.5MHz	93% @ 3A	60mΩ	2.7 - 6.0	0.8 - 0.9 x V_{IN}	4	3mm x 3mm QFN 10-Pin
MP28128	1.5MHz	95% @ 1.5A	60mΩ	2.7 - 6.0	0.8 - 0.9 x V_{IN}	2.5	3mm x 3mm QFN 10-Pin

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POWER TRANSISTORS

Reflecting high demand in computer and industrial power supplies, the market for power transistors in 2007 grew 5.8%. Power transistor revenue, particularly MOSFETs, grew well (11%) in switching power supplies and direct current to direct current (DC-DC) converters in computers and communications switching stations. The industrial and medical sectors, users of insulated-gate bipolar transistor (IGBT) motor drives, grew power transistor revenue 12% in 2007. And the consumer sector, particularly appliances, remained strong users of bipolar power devices, with power transistor revenues increasing 4%. For power transistors it's helpful to look at companies by product end-use: Military, automotive, and computers.

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Automobile electronics seek to plug power leaks
http://www.edn.com/article/CA6570998.html

Military: International Rectifier was the largest player in power transistors for military applications, though its growth here was flat from 2006 to 2007.

Automotive: Infineon posted a 47.9% gain in power transistors for this market followed by Fuji Electric, (ranked fifth), which grew 22.0%. Mitsubishi (with a 3.7% revenue gain) was ranked second, International Rectifier (with a 4.4% revenue gain) was ranked third in automotive applications and Vishay (with a 12.4% revenue gain) was ranked fourth.

Computers: Its strength in computers kept Fairchild Semiconductor as the top power transistor supplier.

Top 10 Power Transistor Vendors

by Worldwide Revenue, 2007 (Millions of Dollars)

2006 Rank	2007 Rank	Vendor	2006 revenue	2007 revenue	2006-2007 change (%)	Market share (%)
1	1	Fairchild Semiconductor	898	935	4%	11%
3	2	Infineon Technologies (including Qimonda)	751	924	23%	11%
2	3	International Rectifier	789	809	3%	10%
5	4	Toshiba	668	718	7%	9%
4	5	STMicroelectronics	688	666	−3%	8%
6	6	Mitsubishi	656	662	1%	8%
7	7	Vishay	474	562	19%	7%
8	8	Fuji Electric	367	475	29%	6%
9	9	NEC Electronics	315	321	2%	4%
10	10	ON Semiconductor	301	311	3%	4%
		Others	1927	1906	−1%	22%
		Total Market	**7834**	**8289**	**6%**	**100%**

*Rankings and data provided by Gartner – Dataquest, July 2008

Ultra-Low Power LDOs

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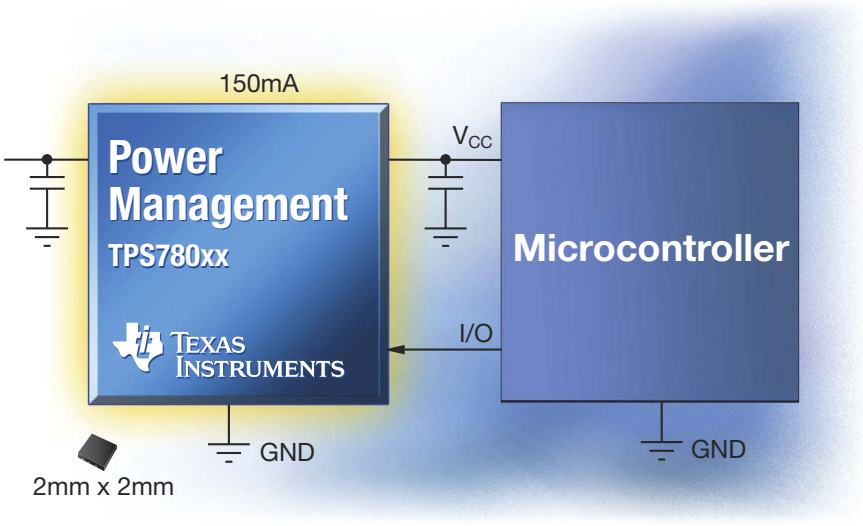
Applications

- TI MSP430-based applications and other microcontrollers
- Power rails with programming mode
- Wireless handsets and other low-power, battery-powered products

Features

- Low I_Q: 500nA (typ)
- Available in fixed output voltages from 1.5V to 4.2V using innovative factory EPROM programming
- Available in adjustable versions from 1.22V to 5.25V
- V_{SET} pin toggles output voltage between two factory-programmed voltage levels
- Stable with a 1.0µF ceramic capacitor
- Logic level compatible enable pin
- Price: $0.65 (1k)



TI's **TPS780xx** LDOs with dual-level voltage output for low-power, battery-powered devices consume only 500nA of quiescent current. The LDOs implement dynamic voltage scaling (DVS), using a voltage select (V_{SET}) pin to allow switching between two voltage levels to customize and cut power consumption.

Device	V_{IN} (V)	I_{OUT} (mA)	V_{OUT} (V)	I_Q (µA)	Package	Price (1k)*
TPS780xx	2.2 - 5.5	150	1.22 - 5.25	500nA	TSOT-23, SON	$0.65
TPS781xx	2.2 - 5.5	150	1.22 - 5.25	1	TSOT-23, SON	$0.50
TPS797xx	1.8 - 5.5	10	1.25 - 4.9	1.2	SC70	$0.34
TPS715xx	2.5 - 24	50	1.2 - 15	3.2	SC70	$0.34
TPS715Axx	2.5 - 24	80	1.2 - 15	3.2	SON	$0.44

** Suggested resale price in U.S. dollars in quantities of 1,000.*

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EDN's BEST OF BEST

POWER MANAGEMENT IC's

The voltage regulator market is poised to grow at a compound annual rate of 7.2% from 2006 to 2011, a slightly higher rate than the 6.4% CAGR Gartner projects for the analog IC market in general — but significantly more than the 4.8% CAGR projected for the semiconductor industry as a whole. However, within the three dominant market segments — computer boards, large computer and communications installations, and consumer electronics — there's quite a bit of variation.

Computer boards: Of the two principal voltage regulator types, linear and switched-mode, Gartner projects revenue for switch-mode regulators to grow faster than linear IC regulators because the computer-board market values switched-mode's higher efficiency and lower heat dissipation. Non-isolated dc-dc converters, typically used as point-of-load (POL) voltage regulators on computer boards, will show the fastest growth at 13.3% CAGR, and switch-mode controllers and sequencers will have a CAGR of 6.6%. However, linear voltage regulators will still remain popular because of their ease of use and low cost, and price erosion will keep their revenues relatively flat (1.9% CAGR) despite high unit demand.

Large computer and communications installations: Each computer card can use a dozen regulators, with hundreds of regulators per system, so the key demands are low-profile packaging and high energy-transfer efficiency. The higher average selling prices for these regulators will mean an 8.8% CAGR for ICs in computer systems, a 7.0% CAGR in communications routers and switching stations, and an 11.4% CAGR in wireless applications, particularly mobile infrastructure.

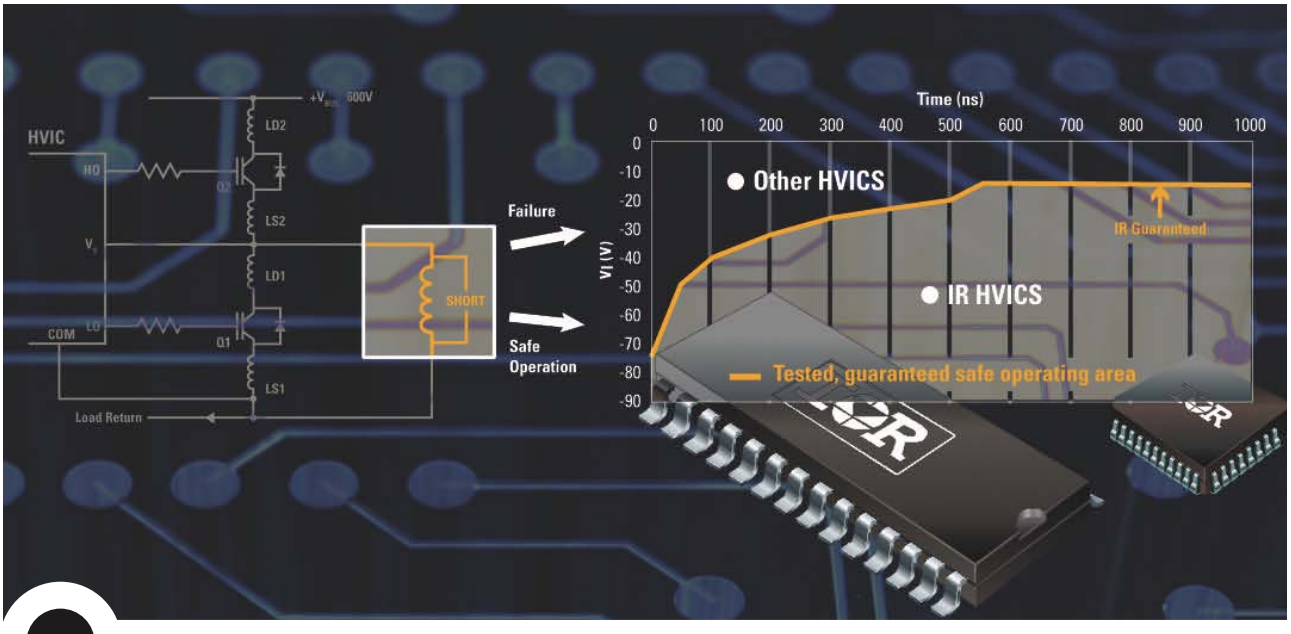
Consumer applications: The market here will be relatively flat at 2.5% CAGR, reflecting a reliance on low-cost linear regulator types. But watch out in 2010, when the impact of government and environmental agency recommendations, such as the energy-efficient EnergyStar specifications begin to be felt.

Top 10 Voltage Regulator Vendors

by Worldwide Revenue, 2007 (Millions of Dollars)

2006 Rank	2007 Rank	Vendor	2006 revenue	2007 revenue	2006-2007 change (%)	Market share (%)
1	1	Texas Instruments	1020	1096	7%	13%
2	2	National Semiconductor	894	899	1%	11%
3	3	Maxim	631	664	5%	8%
4	4	Linear Technology	577	551	−5%	7%
6	5	On Semiconductor	354	387	9%	5%
7	6	STMicroelectronics	348	368	6%	4%
5	7	Intersil	373	361	−3%	4%
10	8	Sankin	216	304	41%	4%
8	9	Fairchild Semiconductor	261	250	−4%	3%
12	10	Fujitsu	190	200	5%	2%
		Other	3077	3220	5%	39%
		Total Market	**7941**	**8300**	**5%**	**100%**

Source: Gartner (June 2008)



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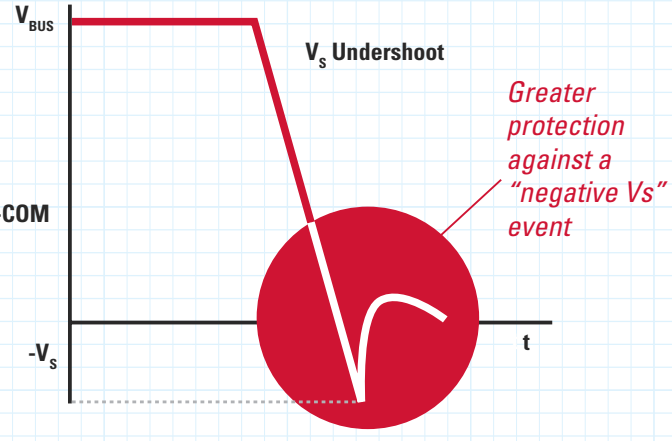
Features

Part Number	Single-Phase	3-Phase	Negative Vs Immunity	Integrated Bootstrap	Advanced Input Filter	Current Sense OPA	Ground Fault Detection	DC Bus Sensing	Brake/PFC Drive
IRS260xD	X		X	X	X				
IRS2336D		X	X	X	X				
IRS233xD		X	X	X	X	X			
IRS26302D		X	X	X	X		X		X
IRS26310DJ		X	X	X	X			X	



- Designed and characterized to be tolerant to repetitive negative Vs transient voltage
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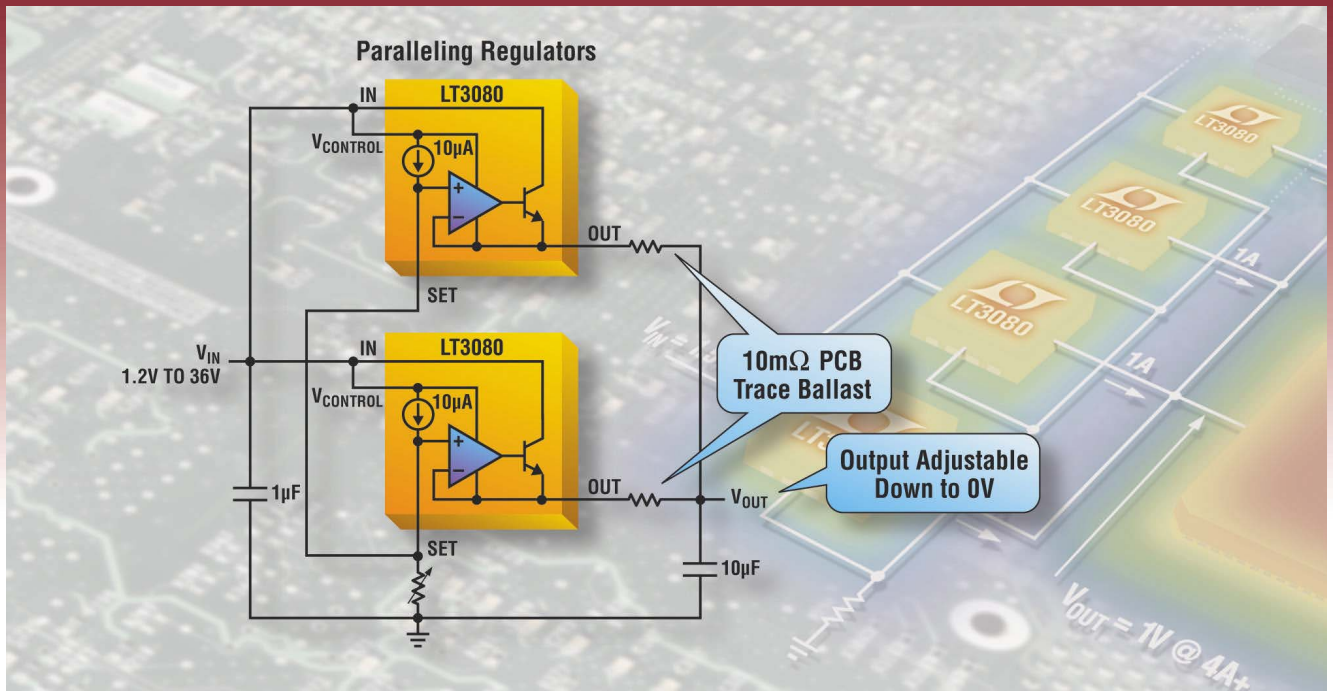


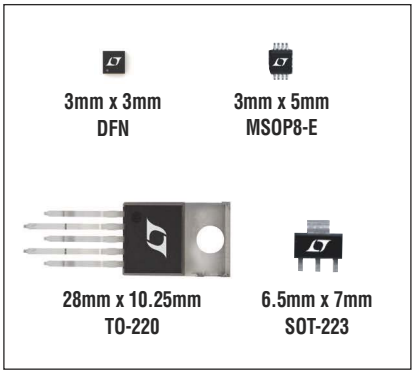
Easily Paralleled: Get High Output Current Without Hot Spots!

The LT®3080 is a new generation of linear regulator compatible with modern surface mount circuit design. Its input voltage is specified up to 36V, providing good margin for transients in many applications. Also, the output of the LT3080 is adjustable with a single resistor down to 0V and devices are easily paralleled for higher output current or to spread PCB heat. The input to output dropout is 1.3V when used as a three terminal regulator. The collector of the power device can be connected separately from the control circuitry to enable dropout voltages of only 300mV, ensuring high efficiency conversion.

Features

- Outputs Can Be Paralleled
- Output Current: 1.1A
- Low Dropout Voltage: 300mV @ 1.1A
- Low Noise: 40µV_{RMS} Wideband (100kHz)
- Stable 10µA Current Source Reference
- Single Resistor Programs V_{OUT}
- V_{OUT} Down to 0V
- V_{IN} Up to 36V (40V Abs Max.)

LT3080 Packaging Options



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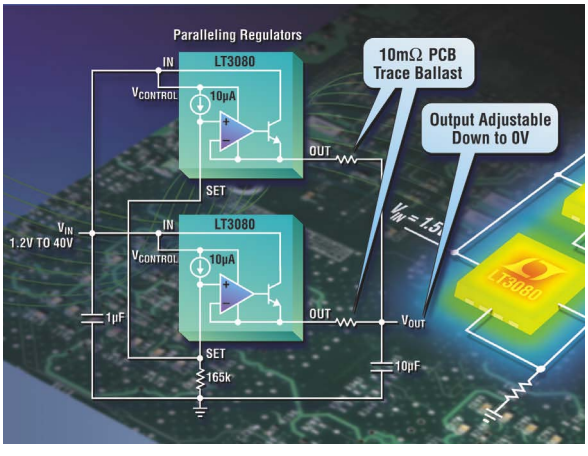
LINEAR TECHNOLOGY

Directly Parallelable Linear Regulator Is Compatible with Modern Surfacemount PC Board Design

Surfacemount board design has evolved with the advent of more sophisticated manufacturing techniques, multilayer PCBs, smaller & thinner discrete components and thinner IC packages. Traditionally, linear regulators in power packages with heat sinks or switching regulators have been used in these systems when high current levels were needed. However, a new breed of linear regulator is available, the LT®3080. The device features a new current-based reference architecture which solves the previous problems associated with these types of designs. This innovative IC offers the ability to obtain higher output currents via direct paralleling, spreading PCB heat without heat sinks, single resistor V_{OUT} setting and adjustable output voltages down to 0V, all with low output noise.

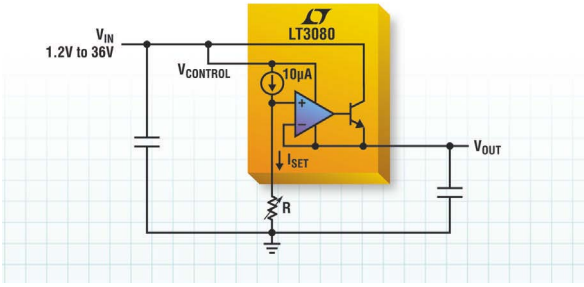
The LT3080 1.1A LDO achieves high performance without any compromises and is ideal for modern multiple-rail systems. Featuring wide input voltage capability from 1.2V to 36V (40V abs max), it has a low dropout voltage of 300mV (two supply operation) at full load, limiting power dissipation and increasing overall system efficiency. The output voltage is adjustable and settable with a single resistor, spanning a wide range from 0V to 35.7V (2-supply operation) and the on-chip trimmed current reference achieves high accuracy of ±1%. Output noise is only 40μV_{RMS} over a wide 10Hz to 100kHz bandwidth. There is no limit to the number of regulators that may be paralleled.



Easily Paralled Regulators

Directly Paralleling ICs Spreads the Heat

Paralleling regulators on a PC board spreads the heat, increases maximum output current compared to a single IC and helps maintain low peak board temperatures. Traditionally, this has required an external op amp and several resistors to implement. However, the LT3080 may be easily and directly paralleled (i.e. no op amp) for heat spreading and features an adjustable output with a single resistor. This allows an all surfacemount solution with the LT3080 where switchers were once used or where noise requirements dictated the use of linear regulators mounted on a heat sink. Until now, high current outputs were limited by the ability of a surface mount board to dissipate the associated power – about 2W. Now the heat generated can be spread over several regulators allowing higher output currents. This regulator uses an innovative current reference and follower architecture to allow current sharing between multiple regulators with a small length of PC trace as ballast, enabling multiamp linear regulation in an all surfacemount system without heat sinks.



Single Resistor V_{OUT} Set

Variety of Packages

The LT3080 is offered in a variety of thermally-enhanced surfacemount compatible packages including the low profile (0.75mm) 8-lead DFN (3mm x 3mm), an 8-lead thermally-enhanced MSOP and simple-to-use 3-lead SOT-223 package. These packages are able to dissipate 1W to 2W in surface mount applications without the need of a heat sink. In addition, the device is housed in a TO-220 power package for mounting to heat sinks for higher power dissipation operation.

Conclusion

Traditionally, multiple-rail, surfacemount PCB systems have been populated with linear regulators in power packages with heat sinks, adding size, complexity and cost, or switching regulators for high current applications. However, a new breed of linear regulator is now available, the LT3080. With its current based reference architecture, it solves the problems associated with these types of designs including excessive localized heat, heat sinks & excess wires and numerous passive components. This innovative IC now offers the ability to obtain virtually unlimited high output current via direct paralleling, spreading of PCB heat without heat sinks, setting V_{OUT} with a single resistor and adjusting the output voltage down 0V, all while emitting low output noise.

LINEAR TECHNOLOGY

Thermal Considerations for High Current LDOs:

Microchip Technology's MCP1727 and MCP1827/S 1.5A, 6V LDOs

Battery-operated equipment has created a strong demand for integrated circuits in smaller packages. While such packages save space, they also have poor heat transfer characteristics. To minimize power dissipation, linear regulators are designed to work with very low input/output voltage differentials – hence the name Low Dropout Regulators or LDOs. LDOs specify maximum output current and input voltage limits. For example, Microchip's MCP1727 and MCP1827 have a maximum output current of 1.5A with an input voltage limit of 6V. However, blindly operating these LDOs to their limits without understanding their power dissipation capabilities can lead to trouble. Even though data sheets and package manufacturers provide power-handling data for packages, it is impossible to specify the true capability for specific applications when power handling can vary significantly due to design and layout.

Heat is removed from the dissipating energy source by three means: conduction, convection and radiation.

Conduction

Heat is conducted from the junction of the power dissipating device through the silicon, package material, lead frame, and printed circuit board. Increasing copper trace size and improving thermal interface (using thermal grease or films) can significantly improve conduction cooling efficiency. The table to the right shows the effects of the material used, as thermal conductivity varies widely and should not be overlooked. It should also be noted that the metal slabs associated with DFN packages, in which the MCP1727 is available, and DDPAK packages, which the MCP1827 is available, improves heat dissipation through conduction.

Material	k (cal/m*C*s)
Silver	98
Copper	83
Fiber Glass	0.011
Air (dry)	0.006

Convection

Convection is the transfer of energy (heat) through a fluid or medium (air), and is determined by the thermal resistance of the junction to ambient from the die. For natural convection, air currents are set up by the rising of heated air and the falling of cooling air. Heat sinks and/or forced air techniques may be used to drastically decrease this thermal resistance significantly, but not without impacting system size and cost. The MCP1827 is available in the TO-220 package, which integrates a metal tab for easily mounting a heatsink.

Radiation

Radiation is another method of heat transfer that is applicable to the surface mount environment. A material whose temperature is elevated will emit more energy than the same material with a cooler temperature. In an application, if there is a large component dissipating a significant amount of heat, it will elevate the temperature of adjacent smaller components. Thus, it is best to be careful with the layout of the board.

Considering all of the methods of heat transfer and mounting variations, it is difficult to accurately determine the power dissipation capability for small surface mount packages in system level applications.

Microchip's **MCP1727**, **MCP1827** and **MCP1827S** Low-Dropout Regulators (LDOs) support input voltages ranging from 2.3V to 6.0V and output voltages from 0.8V to 5.0V, while having a full-current dropout voltage of only 330 mV (typical). The devices feature a quiescent current of 120 µA for low-power consumption during regulation and are ceramic output-capacitor stable to help reduce design costs and size.

The full-featured MCP1727 incorporates shutdown, power good, programmable power good delay and bond-wire compensation, all on a single chip. The mainstream 5-pin MCP1827 LDO includes power-good and shutdown functions, while the 3-pin MCP1827S is a more cost-effective alternative, for those applications that do not require power good and shutdown.

Product	Features	Output Voltage	Active Current	Dropout Voltage @1.5A	Output Voltage Accuracy	Package	Volume Pricing
MCP1727	Shutdown, Power Good, Delay, Sense	0.8V-5.0V	140 µA	330 mV	0.50%	8-DFN, 8-SOIC	$1.09
MCP1827	Shutdown, PowerGood	0.8V-5.0V	120 µA	330 mV	2%	5-DDPAK, 5-TO-220	$1.11
MCP1827S	3-pin	0.8V-5.0V	120 µA	330 mV	2%	3-DDPAK, 3-TO-220	$1.03

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Top 20 Photovoltaic Cell Producers

Rank	Company	Country of origin	Cell Technology	Capacity 2008 (Announced)
1	Sharp Electronics	Japan	Crystalline (1)	870
2	Q-Cells	Germany	Crystalline (1)	834
3	Suntech Power Holdings Ltd	China	Crystalline (1)	590
4	First Solar	USA	Thin-Film	484
5	SolarWorld	Germany	Crystalline	460
6	Sanyo	Japan	Crystalline	365
7	BP Solar	UK	Crystalline	480
8	Kyocera	Japan	Crystalline	300
9	Motech Industries Inc.	Taiwan	Crystalline	330
10	Solarfun Power Holdings	China	Crystalline	360
11	SunPower Corp.	USA	Crystalline	414
12	Gintech Energy Corporation	Taiwan	Crystalline	300
13	E-TON SOLAR TECH	Taiwan	Crystalline	320
14	Yingli Green Energy	China	Crystalline	400
15	CEEG Nanjing PV Tech Co.Ltd.	China	Crystalline	390
16	China Sunergy Co. Ltd	China	Crystalline	320
17	Mitsubishi	Japan	Crystalline (1)	280
18	Ersol Solar Energy AG	Germany	Crystalline	220
19	Jing Ao Solar Co Ltd.	China	Crystalline	175
20	Moser Baer Photovoltaic	India	Crystalline (1)	120
	Total (in MW)			**8012**
	Total for Top 10			**5073**

(1) Plants are mostly crystalline, but also produce thin-film

Source: iSuppli, analyst Dr. Henning Wicht, Senior Director and Principal Analyst Photovoltaics and MEMS

EDN's BEST OF BEST

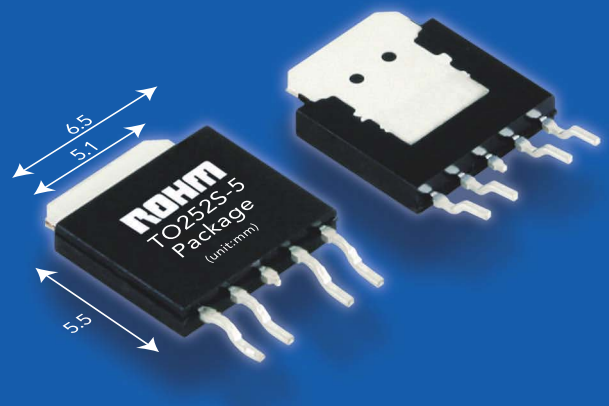
SOLAR ENERGY: PHOTOVOLTAICS

The market drivers for photovoltaic energy are in place: Global energy requirements will increase by 3 to 4 times in the next 50 years while fossil fuel prices continue to rise. In addition, the EU countries are mandated to reduce CO2 production by the year 2020 by 20% and to generate 20% of their total energy from renewable energy sources. iSuppli senior director and principal analyst Dr. Henning Wicht estimates that the international production of photovoltaic cells will grow from 6B € in 2007 to 18B € in 2010.

However, for the next two years the photovoltaic industry will face continued shortages in silicon, a basic raw material for the industry. In addition, government subsidies continue to play an important role in solar energy end pricing. In Germany, the largest EU country user of solar energy, the current successful subsidies will start to decrease at 5% per year, forcing photovoltaic end prices to fall an equivalent amount to keep parity. In the US, tax incentives for investment in photovoltaic systems end in December 2008, and may or may not be extended. Japan directly supports new photovoltaics installations, but China has none at this time.

Expand Your Innovations

900 kHz Step-down Regulator Improves Efficiency and Reduces Space



BD9870FPS

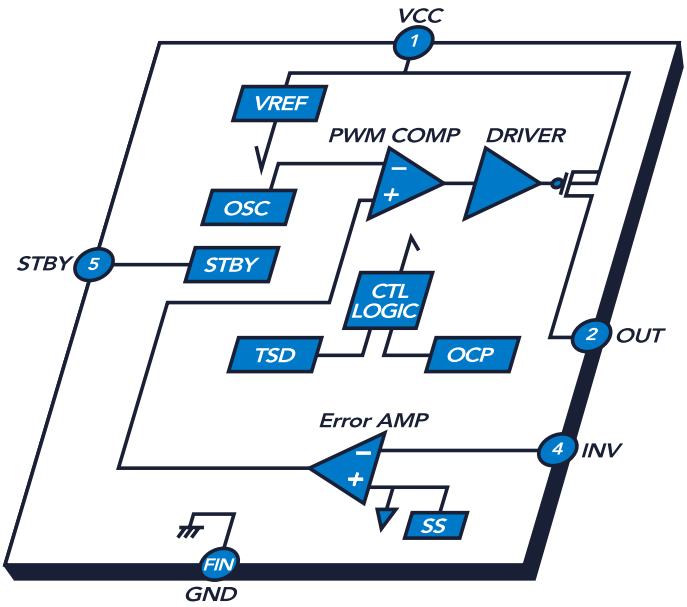
The BD9870's integrated protection and compensation circuitry, smaller external components and ceramic input/output capacitor compatibility result in space savings of up to 60%.

Features

- 900kHz oscillation frequency reduces external coil size (10µH)
- Compatible with ceramic capacitors at output LC filter
- Built-in Pch MOSFET (diode rectification)
- Only 3 external components required: coil, diode, output capacitor
- Integrated Over-Current Protection (OCP) and Thermal Shutdown (TSD) circuits
- Built-in phase compensation circuitry
- Soft start function

Applications

- TVs
- Printers
- Gaming consoles
- Car audio and navigation
- Communication devices
- A/V equipment
- Office and industrial equipment



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EDN's BEST OF BEST

SOLAR ENERGY: EMERGING TECHNOLOGIES

Photovoltaic cells are not the only way to harness the sun's energy. Solar thermal energy uses focused sunlight to heat water which then powers an electricity-generating turbine. Companies such as eSolar (www.esolar.com) and Ausra (www.ausra.com) in California are developing installations. (For comparing relative costs of solar energy technologies, see table below: Solar energy costs.)

In addition, there's a possible disruptive technology on the horizon: In June of this year, California start-up Nanosolar demonstrated it 1GW (in annual production) solar ink coating machine, which the company says costs $1.65M. The coater, which works in a normal factory environment, and coats metal film with a proprietary ink based on a Copper-Indium-Gallium-Diselenide (CIGS) compound. Nanosolar's coating process is inherently cheaper and simpler than traditional silicon wafer deposition processes used in today's photovoltaic cells. The efficiency of the Nanosolar technology is less: 14% compared to as high as 25% silicon wafer efficiency. But 14% is still very practical and its lower cost make it a technology to watch.

MORE AT EDN.COM:
Non-US solar market may hold more promise due to US economy
http://www.edn.com/blog/450000245/post/110029611.html

Solar Energy Costs

Cost per kWhr ($)	Electricity generated from
0.05	Coal
0.10	Natural Gas
0.16	Solar Thermal
0.24	Utility-scale Photovoltaic
0.40	Individual (rooftop) Photovoltaic

Emerging Solar

EDN's BEST OF BEST

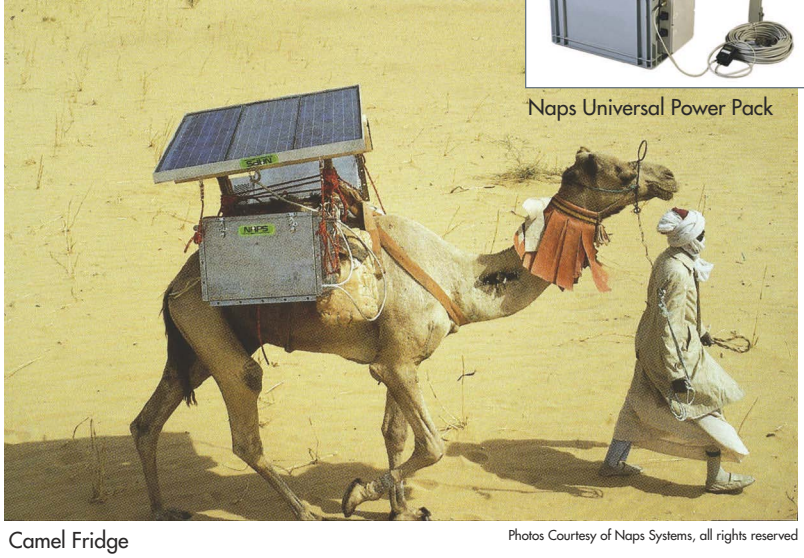
PHOTOVOLTAIC APPLICATION

Camel Fridge: A novel, mobile, solar-powered refrigerator.

One of the monumental health projects of our time has to be the effort to bring vaccines into remote, rural regions of the world. Vaccines must be kept cool, and in remote rural regions where it's too darn hot to begin with, a reliable source of electricity is usually not a feature.

A Finnish company, NAPS Systems, (www.napssystems.com) addressed this need in the 1980's with this mobile camel-solar-powered refrigerator. This version evolved into a more boring Naps Universal Power Pack. The Universal Power Pack comprises 4 50W solar panels, and 2 100 A-hour 12V lead-acid batteries and can power the CFS49IS, a 49-liter vaccine refrigerator. The whole thing weighs about 300kg. And yes, the CFS stands for Camel Fridge Systems.

Naps Universal Power Pack



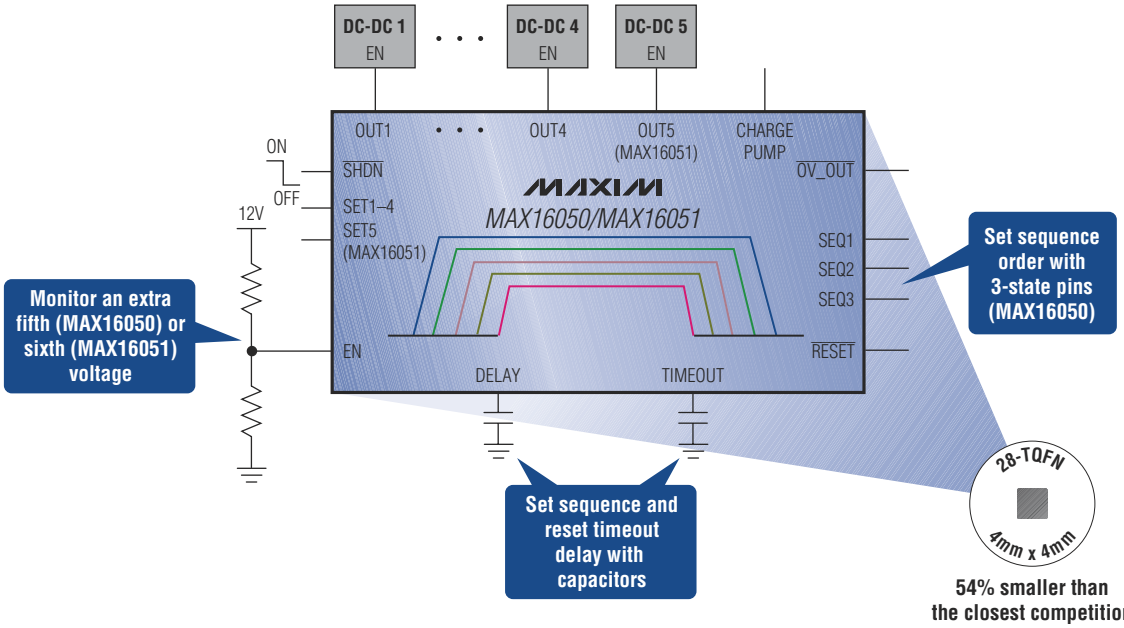
Camel Fridge

MAXIM 1983 • 2008 25 YEARS OF ENGINEERING SUCCESS

Sequencing made simple

Key advantages

1) Highest integration in its class 2) No software required 3) Smallest solution



54% smaller than the closest competition

Sequence more channels than the competition

- Sequence five and monitor six channels for overvoltage and undervoltage
- Daisy-chain multiple devices for sequencing additional channels
- Reverse sequencing

Additional benefits

- Wide, 2.7V to 13.2V operating range
- Discharge output capacitors on shutdown with 85mA internal pulldowns
- Pin-configurable sequencing controlled through three 3-state pins (MAX16050)

Part	No. of voltages monitored	No. of outputs/FET drivers	Reverse sequencing	Overvoltage monitoring	Operates off of intermediate bus voltage	Package (mm x mm)
MAX16050	5	4/1	✓	✓	✓	28-TQFN (4 x 4)
MAX16051	6	5/1				

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Power management by design

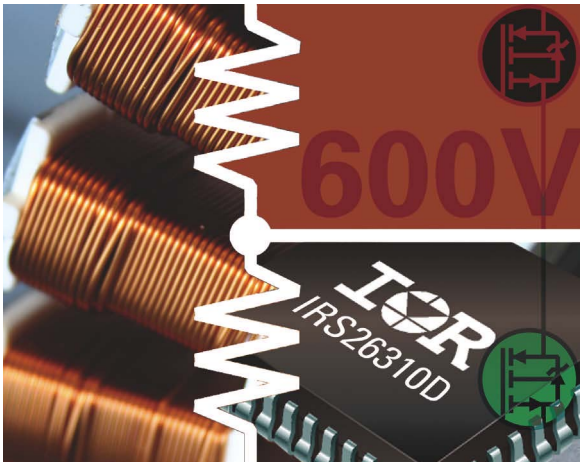
AT THE FOREFRONT OF POWER MANAGEMENT TECHNOLOGY, IR CONTINUES TO INTRODUCE INNOVATIVE PRODUCTS FOR ENERGY-EFFICIENT APPLIANCES AND IT APPLICATIONS.

The IR3502 XPhase® control IC for Intel® VR11.0 and VR11.1 processors provides overall system control and interfaces with any number of IR's XPhase phase ICs. The IR3502's key features include 0.5 percent overall system set point accuracy and daisy-chain digital phase timing for accurate phase interleaving without the need for external components. Combined with the IR3507 phase IC, the chipset provides the PSI capability to improve VRM light load efficiency.

IR's 30 V DirectFET® MOSFETs for notebook computers, server CPU power, graphics, and memory voltage regulator applications, combine IR's latest generation HEXFET® power MOSFET silicon and advanced DirectFET packaging technology to achieve a 40 percent smaller footprint compared to a standard SO-8 device. The IRF6724M, IRF6725M, IRF6726M, and IRF6727M are characterized with very low $R_{DS(on)}$ making them well suited for high current synchronous MOSFETs. The very low Q_g and Q_{gd} offered by the IRF6721S, IRF6722S and IRF6722M make these devices ideally suited for control MOSFETs.

The SupIRBuck™ IR380x family is optimized for high performance consumer POL applications including game consoles, desktop PCs, graphics cards, set-top boxes and LCD TVs. The new devices integrate IR's high performance control ICs optimized with benchmark HEXFET MOSFETs in a compact 5mm x 6mm power QFN package to enable up to 70 percent space savings compared to discrete solutions, while maintaining an equivalent overall total solution cost. SupIRBuck is designed for 4, 7 and 12 amps of output load current at 600kHz and 6, 9 and 14 amps at 300kHz respectively. Key features include wide range input of 2.5 V to 21 V and output range of 0.6 V to 12 V, pre-bias start up and a choice of two fixed switching frequencies.

The IRS26310DJPbF three-phase gate driver IC for motor drive applications including Permanent Magnet (PM) motor drives integrates power MOSFET and IGBT gate drivers with three high-side and three low-side referenced output channels to provide 200mA/350mA



drive current at up to 20 V MOS gate drive capability operating up to 600 V. The IC incorporates an integrated bootstrap diode and protection features including improved negative voltage spike (V_s) immunity to protect the system from catastrophic events. An advanced input filter is also integrated. Application-specific protection features include DC bus sensing with over-voltage protection and a zero vector braking function for PM motor drives.

The IRS260xD family of single-phase high-voltage ICs for motor drive applications including air conditioners, fans and general purpose inverter drives offers optional dependent or independent high- and low-side referenced output channels with a gate drive supply range from 10 V to 20 V. The output drivers feature a high-pulse current buffer stage designed for minimum driver cross-conduction while the floating channel can be used to drive N-channel power MOSFETs or IGBTs in the high-side configuration operating up to 600 V. The devices provide matched propagation delay for both channels and an advanced input filter in addition to negative V_s immunity to protect the system against catastrophic events.

IR has recently expanded its portfolio of 60 V, 75 V and 100 V MOSFETs for SMPS, UPS and industrial applications. These new devices feature low $R_{DS(on)}$ and high switching capability while the rugged TO-247 package provides a larger area for heat sinking to improve thermal dissipation compared to a TO-220 package. Additionally, a family of 60 V and 75 V N-channel MOSFETs optimized for industrial battery applications is available in TO-220, D-PAK and D2 PAK packages, utilizing IR's trench MOSFET technology with superior $R_{DS(on)}$ for improved system efficiency and high reliability. All of the new MOSFETs are offered lead free, and are RoHS compliant.

International
IOR Rectifier

EDN's BEST OF BEST

DIGITAL POWER

Digital power comprises two different capabilities: The first and relatively simple, capability, digital communication, allows a system host to monitor and control the power subsystem. The second, and much more complex capability, is closing the power feedback loop digitally. Proponents of the well-established analog feedback loop disparage digital power loop control as being complex, expensive, and adding only a small increase in efficiency, perhaps only half a percent. In 2006, the total market for digital power management ICs was about $6M.

The introduction of at least five digital management ICs in 2007 focused attention on the young market, and market analysts made predictions for its size to be anywhere from $800M to $1B by 2010. Steve Ohr, research director for Gartner Dataquest, came in at a more conservative $387M target for 2011. His prediction looks pretty smart right now, because the digital power market did not take off in the past year and doesn't appear to be on course to hit $1B by 2010.

MORE AT EDN.COM:
A bit-o'-power: digitally controlled power conversion
http://www.edn.com/article/CA624951.html
Lawsuit has implications for digital control of power subsystems
http://www.edn.com/article/CA6506580.html

But Ohr isn't trying to grab bragging rights. "The [digital power] market is starting essentially from nothing, and there are so many unknowns: What will the price of energy do, and how quickly will engineers accept and design in a radically new technology?" Ohr says. "It's crystal ball gazing. I have no idea if its going to grow that fast – or faster."

As an example of the uncertainties in the nascent market, his 2011 forecast included almost nothing for digital power control on the PC mother board, but he points to the apparent early success of CHiL Semiconductor, which has a state-machine-based digital controller with a serial bus control that targets just that market. Who knew?

So while the power supply market has not universally jumped on the digital power bandwagon, today's skyrocketing power bills may accelerate digital power's acceptance now, with even half a percent of power savings justifying the increased parts and engineering costs of digital power.

(Continued on page 22)

(Continued from page 21)

So, because of the turbulence in the digital power market, here is a list of digital power management ICs vendors — in alphabetical order:

- **Analog Devices**
- **ChiL Semiconductor**
- **Linear Technology**
- **Marvell**
- **Maxim**
- **Primarion**
- **Silicon Laboratories**
- **Summit Micro**
- **Texas instruments**
- **Zilker Labs**

Digital Power supplies

In addition to the general uncertainty about the rate of acceptance of digital power, the power supply world has the added uncertainty of a patent claim covering serial bus communication for dc-dc point-of-load (POL) converters. Power-One claims that the PMBus architecture, developed by an industry consortium of power supply manufacturers and power management IC vendors, is the same as Power-One's patented "Z-One" architecture. The power supply industry could be taking a wait-and-see attitude about the outcome of the patent court case, or the relatively slow adoption of digital control for dc-dc POL converters could just be due to caution on the part of end customers, who will have to implement and justify a complex new subsystem communication system. So for this also-new market, the vendors are again ranked in alphabetical order.

- **American Power Systems**
- **Artesyn** (a division of Emerson Electric)
- **Astec** (a division of Emerson Electric)
- **Cherokee International**
- **Coldwatt**
- **Ericsson**
- **Power-One**

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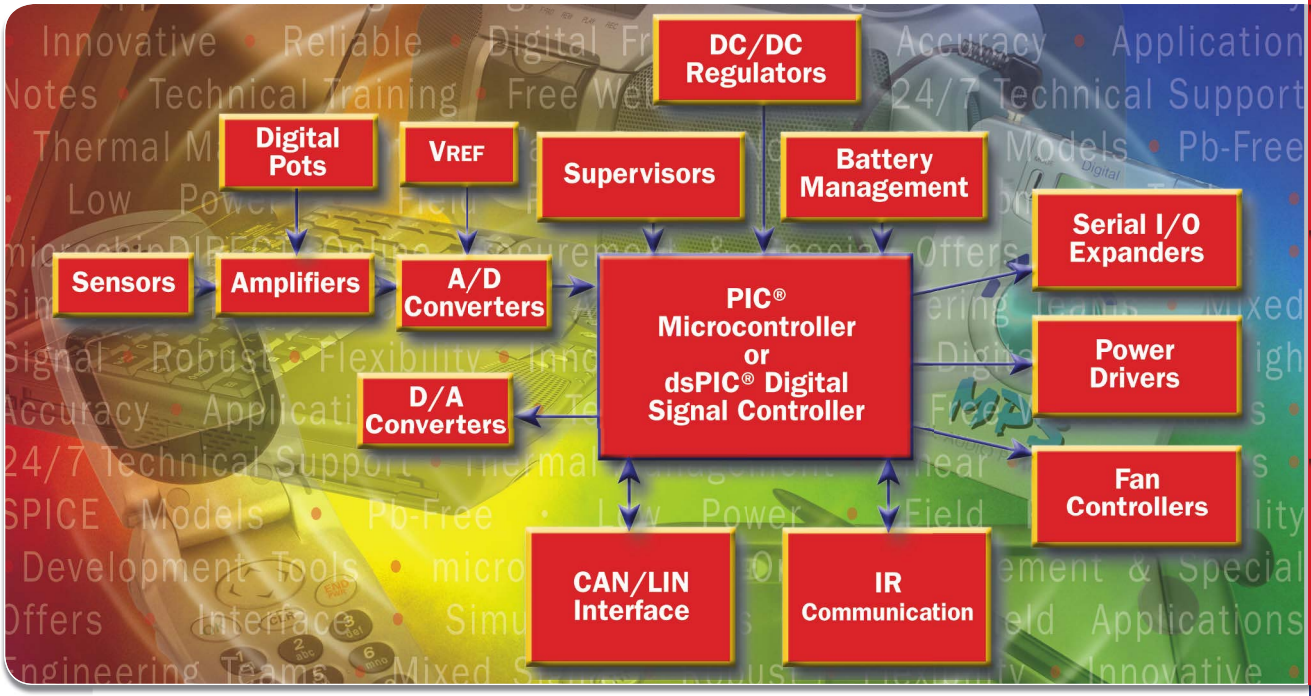

Microchip's broad portfolio of stand-alone analog and interface devices offers highly integrated solutions that combine various analog functions in space-saving packages and support a variety of bus interfaces. Many of these devices support functionality that enhances the analog features currently available on PIC® microcontrollers.

Power Management

- LDO & Switching Regulators
- Charge Pump DC/DC Converters
- Power MOSFET Drivers
- PWM Controllers
- System Supervisors
- Voltage Detectors
- Voltage References
- Li-Ion/Li-Polymer Battery Chargers

Mixed-Signal

- A/D Converter Families
- Digital Potentiometers
- D/A Converters
- V/F and F/V Converters
- Energy Measurement ICs

Linear

- Op Amps
- Programmable Gain Amplifiers
- Comparators
- Linear Integrated Devices

Interface

- CAN Peripherals
- Infrared Peripherals
- LIN Transceiver
- Serial Peripherals
- Ethernet Controller

Thermal Management

- Temperature Sensors
- Fan Speed Controllers/ Fan Fault Detectors

Visit our Web site for more information about our comprehensive analog offering, related development tools and FREE samples!

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